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Impedimetric aptasensors based on carbon nanotubes - poly(methylene blue) composite

Porfireva A., Evtugyn G., Ivanov A., Hianik T.
Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

The effect of aptamer structure and immobilization platform on the efficiency of thrombin binding and its detection using electrochemical impedance spectroscopy (EIS) characteristics was investigated with aptasensors based on glassy carbon electrodes covered with multiwalled carbon nanotubes (MWNTs). Aptamers with one or two binding sequences GGTTGGTGTGGTTGG specific for thrombin and poly(dA) and poly(dT) tags able to form dimeric products (aptabodies) were used to establish significance of steric and electrostatic factors in aptasensor performance. We have shown that electropolymerization of methylene blue onto MWNTs significantly improved electrochemical characteristics and sensitivity of thrombin detection against bare MWNTs. Charge transfer resistance and capacitance of the surface layer were measured in the presence of redox probe [Fe(CN)6]3-/4-. Aptasensors make it possible to detect thrombin in the concentration range 1 nM-1 mμM with the limit of detection of 0.7 nM (monitoring resistance changes) and 0.5 nM (capacitance changes), respectively. © 2010 Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim.

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Keywords

Biosensors, DNA aptamers, Electrochemical impedance spectroscopy, Electropolymerization, Human thrombin, Methylene blue, Nanotubes